Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

CSAS | **SCCS**

Canadian Science Advisory Secretariat | **Secrétariat canadien de consultation scientifique**

Research Document 2011/125 | **Document de recherche 2011/125**

Quebec Region | **Région du Québec**

Harvest advice for beluga in the Belcher, King George, and Sleeper Islands in relation to the eastern Hudson Bay stock

Avis sur la récolte de bélugas dans les îles Belcher, King George et Sleeper en relation avec le stock de l'est de la baie d'Hudson

T. Doniol-Valcroze and M.O. Hammill

Maurice-Lamontagne Institute, Fisheries and Oceans Canada,
P.O. Box 1000, Mont Joli (QC) G5H 3Z4

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

La présente série documente les fondements scientifiques des évaluations des ressources et des écosystèmes aquatiques du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Research documents are produced in the official language in which they are provided to the Secretariat.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au Secrétariat.

This document is available on the Internet at:

Ce document est disponible sur l'Internet à:

www.dfo-mpo.gc.ca/csas-sccs

ISSN 1499-3848 (Printed / Imprimé)
ISSN 1919-5044 (Online / En ligne)
© Her Majesty the Queen in Right of Canada, 2012
© Sa Majesté la Reine du Chef du Canada, 2012

Canada

Correct citation for this publication:
La présente publication doit être citée comme suit :

Doniol-Valcroze, T. and Hammill, M. O. 2012. Harvest advice for beluga in the Belcher, King George, and Sleeper Islands in relation to the eastern Hudson Bay stock. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/125. iv + 8 p.

ABSTRACT

Subsistence harvest of beluga whales by Nunavik communities is directed towards a mixture of stocks defined by their summering areas, including the endangered Eastern Hudson Bay stock (EHB). It is critical to estimate as accurately as possible how many EHB beluga are harvested, which is made complex by the fact that EHB beluga are harvested in areas other than the eastern Hudson Bay arc (e.g., Hudson Strait, Ungava Bay).

Beluga whales are harvested in spring and fall around the Belcher Islands, which lie in the centre of the arc of eastern Hudson Bay. Their relationship to other summer stocks is relevant for management strategies but remains unclear. Here, we review information from several sources to determine the impact of different allocation schemes in the Belcher, King George and Sleeper Islands on the EHB stock.

Aerial survey observations showed that the distribution of beluga between the Belcher Islands and the eastern shore of Hudson Bay appeared continuous. Satellite telemetry confirmed that EHB beluga made use of offshore areas in eastern Hudson Bay that extended into both the Nunavut Settlement Area and the Equal Use and Occupancy Area. Moreover, several genetic analyses have confirmed that whales frequenting the Belcher Islands area likely represent a variable mixture of stocks, including a significant proportion of EHB whales. All available information thus indicates that the EHB stock is straddling the limits of Nunavut and Nunavik.

Currently, the harvest in Sanikiluaq is monitored but not controlled, except for a municipal motion prescribing that whales should be taken before July 15th or after September 30th. With an annual harvest of about 30-45 whales, it is estimated that Sanikiluaq takes 4-5 EHB whales per year. These whales are included in the EHB population model and thus this harvest has concrete repercussions on the total allowable takes for Nunavik hunters.

The current management scheme regarding Sanikiluaq harvest does not take into account the possibility of a stock specific to the Belchers. The possible existence of a distinct stock around the Belcher Islands would pose an additional challenge for the monitoring of the EHB stock, for which information comes mostly from aerial surveys. Since it is not possible to distinguish between stocks of beluga from the air, there is a risk that whales from the putative Belcher stock would be counted during censuses of the EHB stock, thereby introducing a bias in abundance estimation (the magnitude of which would depend on the actual size of the Belcher stock, and its seasonal distribution).

RÉSUMÉ

La chasse aux bélugas à fins de subsistance par les communautés du Nunavik cible un mélange de plusieurs stocks définis d'après leurs aires de distribution estivale. Ces stocks incluent celui de l'est de la baie d'Hudson (EBH), qui est considéré en voie de disparition. Il est donc critique d'estimer aussi précisément que possible combien de bélugas de l'EBH sont prélevés, mais cette estimation est compliquée par le fait que ces bélugas sont chassés dans d'autres régions (p. ex : détroit d'Hudson, baie d'Ungava).

Des bélugas sont chassés au printemps et en été autour des îles Belcher, qui se situent au centre de l'arc de l'est de la baie d'Hudson. Leur relation avec les autres stocks est pertinente aux stratégies de gestion, mais reste peu claire. Dans ce document, nous synthétisons l'information provenant de plusieurs sources afin de déterminer l'impact de différents scénarios de chasse dans les îles Belcher, King George et Sleeper sur le stock de l'EBH.

Les observations réalisées lors de relevés aériens montrent que la distribution des bélugas entre les îles Belcher et la côte est de la baie d'Hudson apparaît continue. La télémétrie satellite a confirmé que les bélugas de l'EBH fréquentent les eaux au large des côtes jusque dans la zone marine du Nunavut et dans la zone d'occupation et d'utilisation égales. De plus, des analyses génétiques ont montré que les bélugas fréquentant les îles Belcher représentent probablement un mélange variable de stocks, incluant une proportion substantielle de bélugas de l'EBH. Toutes les informations disponibles indiquent donc que le stock de l'EBH chevauche les limites du Nunavut et du Nunavik.

La chasse de Sanikiluaq est actuellement surveillée, mais n'est pas contrôlée, à l'exception d'une motion municipale prescrivant que les bélugas soient chassés avant le 15 juillet ou après le 30 septembre. Avec des prises moyennes de 30-45 bélugas par an, on estime que Sanikiluaq prend environ 4-5 bélugas de l'EBH chaque année. Ces baleines sont incluses dans le modèle de population de l'EBH, et par conséquent cette chasse a des répercussions concrètes sur les niveaux de prises autorisés pour les chasseurs du Nunavik.

Le cadre de gestion actuel ne prend pas en compte la possibilité d'un stock spécifique aux îles Belcher. L'existence d'un stock distinct autour des îles Belcher poserait un défi supplémentaire aux travaux d'évaluation et de suivi du stock de l'EBH, pour lequel les informations proviennent essentiellement de relevés aériens. Comme il n'est pas possible de distinguer les bélugas de différents stocks depuis les airs, il y aurait un risque d'inclure des bélugas appartenant au stock hypothétique des îles Belcher dans les décomptes du stock de l'EBH, introduisant de fait un biais dans l'estimation d'abondance (biais dont l'ordre de grandeur dépendrait de la taille exacte du stock des îles Belcher et de sa distribution saisonnière).

INTRODUCTION

Subsistence harvest of beluga whales by Nunavik communities is directed towards a mixture of stocks defined by their summering areas, including the Eastern Hudson Bay stock (EHB), which was depleted by intensive commercial hunting in the nineteenth century (Reeves and Mitchell 1989, Hammill et al. 2004).

The EHB stock is monitored with a population model incorporating information on catch levels and fitted to aerial survey estimates using Bayesian methods (Hammill et al. 2009). This model indicated that the current stock size was likely stable at about 3,000 individuals but that an annual harvest exceeding 50 EHB beluga would likely result in a decline in the stock (Doniol-Valcroze et al. 2011). Therefore, it is critical to estimate as accurately as possible how many EHB beluga are harvested every year, which is complicated by the fact that EHB beluga are harvested during their spring and fall migrations in areas other than the eastern Hudson Bay arc (e.g., Hudson Strait, Ungava Bay).

Most summer aggregations of belugas from different regions of the Canadian Arctic are genetically differentiated based on mtDNA (Brennin et al. 1997; Brown Gladden et al. 1997, 1999, de March and Postma 2003). In eastern Canada, all studies have clearly demonstrated that the EHB stock is differentiated from the two main stocks in the vicinity, i.e. Western Hudson Bay (WHB) and Cumberland Sound (CUM) stocks. Proportions of the harvest from different areas that belong to the EHB stock can thus be estimated from genetic analyses of harvest samples.

The Belcher Islands lie in the centre of the arc of eastern Hudson Bay. Beluga whales are observed early in spring and throughout summer and fall around the Belcher Islands. Their relationship to other summer stocks is unclear. Despite indications from genetic analyses, they are currently not considered a distinct Nunavut stock (Richard 2010) and are not surveyed separately during Nunavik censuses (Gosselin et al. 2009).

Beluga are hunted from the community of Sanikiluaq, Nunavut. The question of single or multiple summering stocks in eastern Hudson Bay is therefore important for designing strategies for managing exploitation by residents of the communities on the Belcher Islands and on the Eastern Hudson Bay coast. Here, we review relevant information from several sources to determine the impacts of different allocation schemes in the Belcher, King George and Sleeper Islands on the EHB stock.

REVIEW OF INFORMATION AND DISCUSSION

SIGHTINGS AND HARVEST

Beluga have been observed in spring, summer and fall around the Belcher Islands (Manning 1976, Finley 1982, McDonald et al. 1997). Most of the hunt occurs in late June and early July, when belugas migrate past the islands, and a few are taken in the fall. Inuit traditional knowledge also mentions presence and harvest of whales in December and January (voices).

Harvest for the period 1981-1993 ranged from 5 to 30 with a mean of 18.4 (SD= 8.74) (Smith 1998). Harvests levels seem to have increased in recent years. In 2009, a total of 34 beluga were harvested, and in 2010, Sanikiluaq reported 42 beluga harvested between May and June, with 3 sunk.

Beluga are harvested around the islands when they come into areas of open water (McDonald et al. 1997). The locations and dates of hunting thus vary with ice cover. At least 15 beluga were harvested north-east of Sanikiluaq between May 21 and June 4, 2008. In 2009, no hunting took place in May because of too much ice, and the first harvests occurred after June 5 (L. Measures, pers. comm.) The location of hunting could affect the proportion of EHB beluga taken (e.g., west vs. east coast of the islands) and thus additional information is desirable.

AERIAL SURVEYS

Surveys were flown over the eastern Hudson Bay arc in July and early August 1985. Survey lines extended from the coast to west of the Belcher Islands. Beluga were observed in almost equal numbers in coastal waters and offshore in the Bay, mostly east and north-east of Sanikiluaq (Smith and Hammill 1986, Fig. 3). A survey along the same lines was flown in 1993. Sightings were widely distributed between the mainland coast and the Belcher Islands (Kingsley 2000, Fig. 4). Thirty-six percent of sightings were outside the Nunavut Settlement Area (NSA) defined in the Nunavut Final Agreement (Anonymous 1993), but these were on average the larger groups, and represented 71% of the total numbers. Beluga whales were distributed also around the Belcher Islands, particularly to the north, and as far west as the survey extended. Similarly, in 2008, there was no evidence of a discontinuity in the east–west distribution of beluga sightings (Fig. 1).

SATELLITE TELEMETRY

Thirty-four beluga were equipped with satellite transmitters in July or August of 1993 to 2004 at the Little Whale River (n = 30) and the Nastapoka River (n = 4). These individuals (11 females, 18 males and 5 undetermined) were tracked throughout the summer and their fall migration (Lewis et al. 2009).

During July-September, most individuals performed repeated inshore-offshore movements. Of all 34 tagged whales, 32 (i.e., 94%) moved into the Equal Use and Opportunity Area (EUOA) at least once during the tracking period and 29 (i.e., 85%) were located into the NSA at least once (Fig. 2). These proportions changed throughout the summer, increasing from 73% in the EUOA and 60% in the NSA in July to 94% (EUOA) and 79% (NSA) in August. In September, the proportions decreased slightly to 81% (EUOA) and 71% (NSA), then to 68% and 55% in October as some individuals began their fall migration out of the area. Diving activity increased markedly when beluga were located to the north of the Belcher Islands, for the one to two months preceding the fall migration (Bailleul et al., in review). Although beluga used the entire water column when close to the mainland coast, most dives in the vicinity of the Belcher Islands were closer to the sea floor, suggesting benthic activity.

The dates of this movement pattern suggest that the proportion of EHB beluga in the Sanikiluaq harvest should be expected to increase at the end of the summer and peak in August. However, satellite tracking of beluga from Nelson River indicates that some WHB beluga follow a fall migration route along the southern shore of Hudson Bay along the west shore of the Belcher Islands (P. Richard, pers. comm.). If this is true for a substantial proportion of the WHB stock, which is estimated at about 57,000 individuals (Richard 2005), then the proportion of EHB in the harvest could be diluted by the influx of WHB animals, depending on the exact timing of these events and the precise location of the harvest.

GENETIC ANALYSIS

To determine the proportion of EHB belugas that were hunted in the Belcher Islands, a directed sampling program was conducted by DFO starting in 1993. Mitochondrial DNA and nuclear microsatellites were used to discriminate among stocks (de March and Maiers 2001). The genetic composition of belugas hunted in Sanikiluaq was consistent over the years 1984-1997,

with approximately 10% of belugas hunted from Sanikiluaq having genotypes that resembled EHB more than they resemble other stocks.

Using genetic mixture analyses with additional samples, Turgeon et al. (2009) estimated that proportion to be 14% overall, but found that proportions of EHB beluga in Sanikiluaq samples varied between seasons: 4% (s.e. = 3%) in the spring (defined as May-June), 41% (s.e. = 14%) in summer (defined as July and August) and almost 0% in fall (defined as September to November). During the fall, 98% of whales appear to be from WHB, which could be explained by the movement pattern of some WHB beluga described above).

Genetic analyses also showed that Sanikiluaq beluga had both a high haplotype and microsatellite diversity, in proportions that differed from other Hudson Bay stocks (de March and Maiers 2001). The haplotype composition of the whales caught at Sanikiluaq was unusual in that it comprised several haplotypes (H08, H16, H39, H42, H46, H57 and H58) unseen elsewhere. This peculiar haplotype assemblage observed at Sanikiluaq suggests that a distinct group of individuals frequent this area and may intermingle with EHB and WHB stocks around the Belcher Islands.

Beluga harvested in Sanikiluaq and the Belcher Islands could thus form a unique summer stock, not only different from EHB, but from also from WHB. Moreover, the analysis of microsatellite loci suggested that WHB beluga breed with EHB belugas, but not Sanikiluaq beluga. This could mean that Sanikiluaq beluga do not overwinter the same areas as the EHB and WHB stocks. Traditional knowledge from Sanikiluaq reports the occurrence of numerous polynia north and south of the Belcher Islands, as well as occasional hunting of beluga in December-January (McDonald et al. 1997). However, high haplotype and microsatellite diversities could also mean that these samples come from a mixed stock that has variable proportions of other stocks depending on the seasonal timing of the hunt (de March and Postma 2003, Turgeon et al. 2009).

King George and Sleeper Islands have too few samples for genetics to make any definitive conclusions on the proportion of EHB whales in the hunt. Because of their geographic location, it would be reasonable to expect more EHB beluga around the King George Islands than in the Sleeper Islands. Four out of five samples available from the King George Islands had haplotypes characteristic of EHB, but all were hunted on the same day at the same site.

In the current population model, it is assumed that 12% of beluga killed by Sanikiluaq hunters belong to the EHB stock, regardless of season.

CONCLUSION AND MANAGEMENT RECOMMENDATIONS

IMPACT ON EHB STOCK

Aerial survey observations showed that the distribution of beluga between the Belcher Islands and the eastern shore of Hudson Bay appeared continuous. Satellite telemetry confirmed that EHB beluga made use of offshore areas in eastern Hudson Bay that extended into both the NSA and EUOA. Moreover, several genetic analyses have confirmed that whales frequenting the Belcher Islands area likely represent a variable mixture of stocks, including a significant proportion of EHB whales.

All available information indicates that the EHB stock is straddling the limits of Nunavut and Nunavik. Currently, the harvest in Sanikiluaq is monitored but not controlled, except for a municipal motion prescribing that whales should be taken before July 15th or after September 30th. These dates were recently changed to allow harvesting to continue into the summer period

which was defined above as starting in July. An earlier version of the municipal motion stopped hunting at the beginning of July. The low proportion of EHB whales detected by the haplotype analyses for the spring and fall (Turgeon et al. 2009) show that this was a good strategy to minimize the impact on the EHB stock. The telemetry data show a lower proportion of EHB beluga whales in the Belcher Island area in July than in August and September, but the genetic sampling shows an increase in the presence of EHB animals during summer, which was defined as starting in July. The recent changes in harvest dates may have made EHB animals more vulnerable, but more analyses of early July samples are needed to verify this. Overall, with an annual harvest of about 30-45 whales, it is estimated that Sanikiluaq takes 4-5 EHB whales. These whales are included in the EHB population model and thus this harvest has concrete repercussions on the total allowable takes for Nunavik hunters.

Any further increase in Sanikiluaq harvest would be detrimental to Nunavik communities, where hunters already have difficulties accepting what they regard as an unfair situation. In any case, it is critical to the management of the EHB stock that measures be kept in place to focus the Sanikiluaq hunt on the spring and fall seasons. Recent changes in harvesting dates extend harvesting into a transition period where an increased proportion of EHB animals may be taken. However, a dedicated biopsy sampling program would allow a more detailed examination of stock identity of beluga around the Belcher Islands and a better understanding of how these proportions vary spatially and seasonally.

A BELCHER STOCK?

The current management scheme regarding Sanikiluaq harvest is fairly well adapted for the conservation of EHB beluga but does not take into account the possibility of a stock specific to the Belchers, despite the conclusion of recent genetic analyses (de March and Postma 2003, Turgeon et al. 2009).

The use of summering stocks as management units is considered precautionary. By adopting as many stocks as are suggested by available information, even if that information is preliminary and based on small samples, co-managers reduce the risk of over-exploitation (Richard 2010) and limit the possibility of localized depletions (Cope and Punt 2009).

The existence of a distinct stock around the Belcher Islands would pose an additional challenge for the monitoring of the EHB stock, for which information comes mostly from aerial surveys. Since it is not possible to distinguish between stocks of beluga from the air, there is a risk that whales from the putative Belcher stock would be counted during censuses of the EHB stock, thereby introducing a bias in abundance estimation (the magnitude of which would depend on the actual size of the Belcher stock, and its seasonal distribution).

ACKNOWLEDGMENTS

We thank Jean-François Gosselin for advice and constructive discussions on this manuscript and Frédéric Bailleul for assistance with filtering of satellite tagging data.

LITERATURE CITED

ANONYMOUS. 1993. Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty in Right of Canada. Ottawa: Department of Indian Affairs and Northern Development and Tungavik Federation of Nunavut. 229 p.

Brennin, R., Murray, B.W., Friesen, M.K., Maiers, L.D., Clayton, J.W. and White, B.N. 1997. Population genetic structure of beluga whales (*Delphinapterus leucas*): Mitochondrial DNA sequence variation within and among North American populations. Can. J. Zool. 75: 795-802.

Brown Gladden, J.G., Ferguson, M.M., Friesen, M.K. and Clayton, J.W. 1999. Population structure of North American beluga whales (*Delphinapterus leucas*) based on nuclear DNA microsatellite variation and contrasted with the population structure revealed by mtDNA variation. Mol. Ecol. 8: 347-3 63.

De March, B. G. E, and Maiers, L. D. 2001. Stock discrimination of belugas (Delphinapterus leucas) hunted in eastern Hudson Bay, northern Québec, Hudson Strait, and Sanikiluaq (Belcher Islands), using mitochondrial DNA and 15 nuclear microsatellite loci. DFO Can. Sci. Advis. Sec. Res. Doc. 2001/050.

de March, B.G.E. and Postma, L.D. 2003. Molecular genetic stock discrimination of belugas (*Delphinapterus leucas*) hunted in eastern Hudson Bay, Northern Quebec, Hudson Strait, and Sanikiluaq (Belcher Islands), Canada, and comparisons to adjacent populations. Arctic 56:111-124.

Doniol-Valcroze, T., Hammill, M.O. and Lesage, V. 2011. Information on abundance and harvest of eastern Hudson Bay beluga (*Delphinapterus leucas*). DFO Can. Sci. Advis. Sec. Res. Doc. 2010/121. iv + 13 p.

Finley, K.J., Miller, G.W., Allard, M., Davis, R.A. and Evans, C. R. 1982. The belugas (*Delphinapterus leucas*) of northern Quebec: distribution, abundance, stock identity, catch history and management. Can. Tech. Rep. Fish. Aquat. Sci. 1123, 57 p.

Gosselin, J.-F., Lesage, V. and Hammill, M.O. 2009. Abundance indices of beluga in James Bay, eastern Hudson Bay and Ungava Bay in 2008. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/006. iv + 25 p.

Hammill, M.O., Lesage, V, Gosselin, J-F, Bourdages, H, de March B.G.E. and Kingsley, M.C.S. 2004. Evidence for a decline in northern Quebec (Nunavik) belugas. Arctic 57:183-195.

Kingsley, M.C.S. 2000. Numbers and distribution of beluga whales, *Delphinapterus leucas*, in James Bay, eastern Hudson Bay, and Ungava Bay in Canada during the summer of 1993. Fishery Bulletin 98:736-747.

Lewis, A.E., Hammill, M.O., Power, M., Doidge, D.W. and Lesage, V. 2009. Movement and aggregation of eastern Hudson Bay beluga whales (*Delphinapterus leucas*): A comparison of patterns found through satellite telemetry and Nunavik Traditional Ecological Knowledge. Arctic 62(1):13-24.

McDonald, M., L. Arragutainaq, and Z. Novalinga (eds.). 1997. Voices from the Bay: Traditional ecological knowledge of Inuit and Cree in the Hudson Bay Bioregion. Canadian Arctic Resources Committee and Municipality of Sanikiluaq. Ottawa.

Manning, T.H. 1976. Birds and mammals of the Belcher, Sleeper, Ottawa and King George Island, Northwest Territories. Can. Wildl. Serv., Occasional Paper 28. 42 pp.

Reeves, R.R. and Mitchell, E. 1989. Status of white whales, *Delphinapterus leucas*, in Ungava Bay and Eastern Hudson Bay. Canadian Field-Naturalist 103:220-239.

Richard, P.R. 2005 An estimate of the Western Hudson Bay beluga population size in 2004. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/17.

Richard, P.R. 2010. Stock definition of belugas and narwhals in Nunavut. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/022. iv + 14 p.

Smith, T.G. 1998. Seasonal movements and migrations of belugas, *Delphinapterus leucas*, along the Nunavik coastlines: Evidence from harvest statistics, game reports, local knowledge and scientific studies. Prepared for the Department of Fisheries and Oceans Canada. Available from the Maurice Lamontagne Institute, Mont-Joli, Quebec.

Smith, T.G. and Hammill, M.O. 1986. Population estimates of white whale, *Delphinapterus leucas*, in James Bay, Eastern Hudson Bay, and Ungava Bay. Can. J. Fish. Aquat. Sci. 43:1982-1987.

Turgeon, J., Duchesne, P., Postma, L.D. and Hammill, M.O. 2009. Spatiotemporal distribution of beluga stocks (Delphinapterus leucas) in and around Hudson Bay: Genetic mixture analysis based on mtDNA haplotypes. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/011. iv + 14 p.

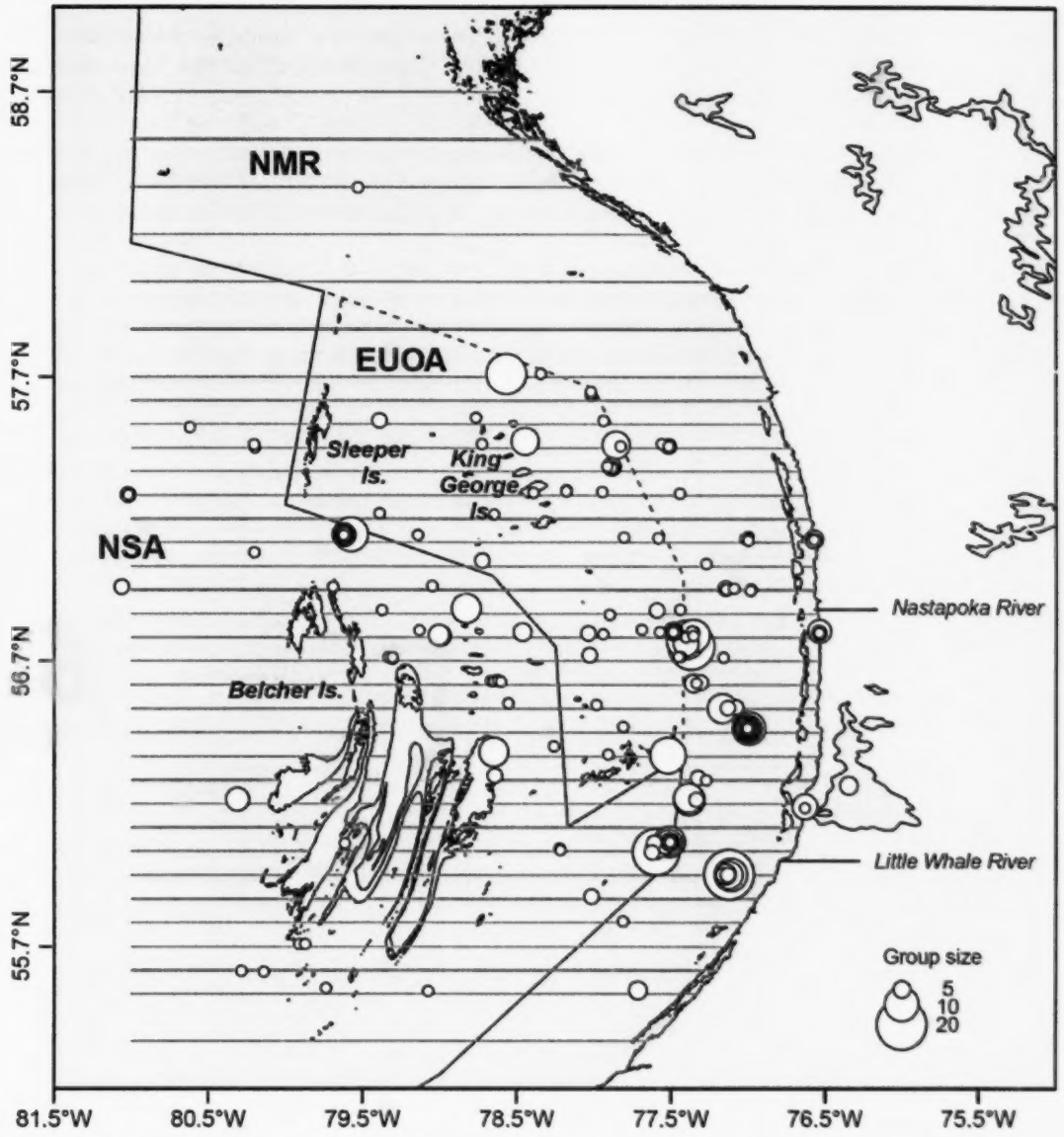

Figure 1. Map of the eastern Hudson Bay arc showing the transect lines of the aerial survey flown in 2008 (black lines) and the sightings of beluga groups (white circles). NMR: Nunavik Marine Area; EUOA: Equal Use and Opportunity Area; NSA: Nunavut Settlement Area.

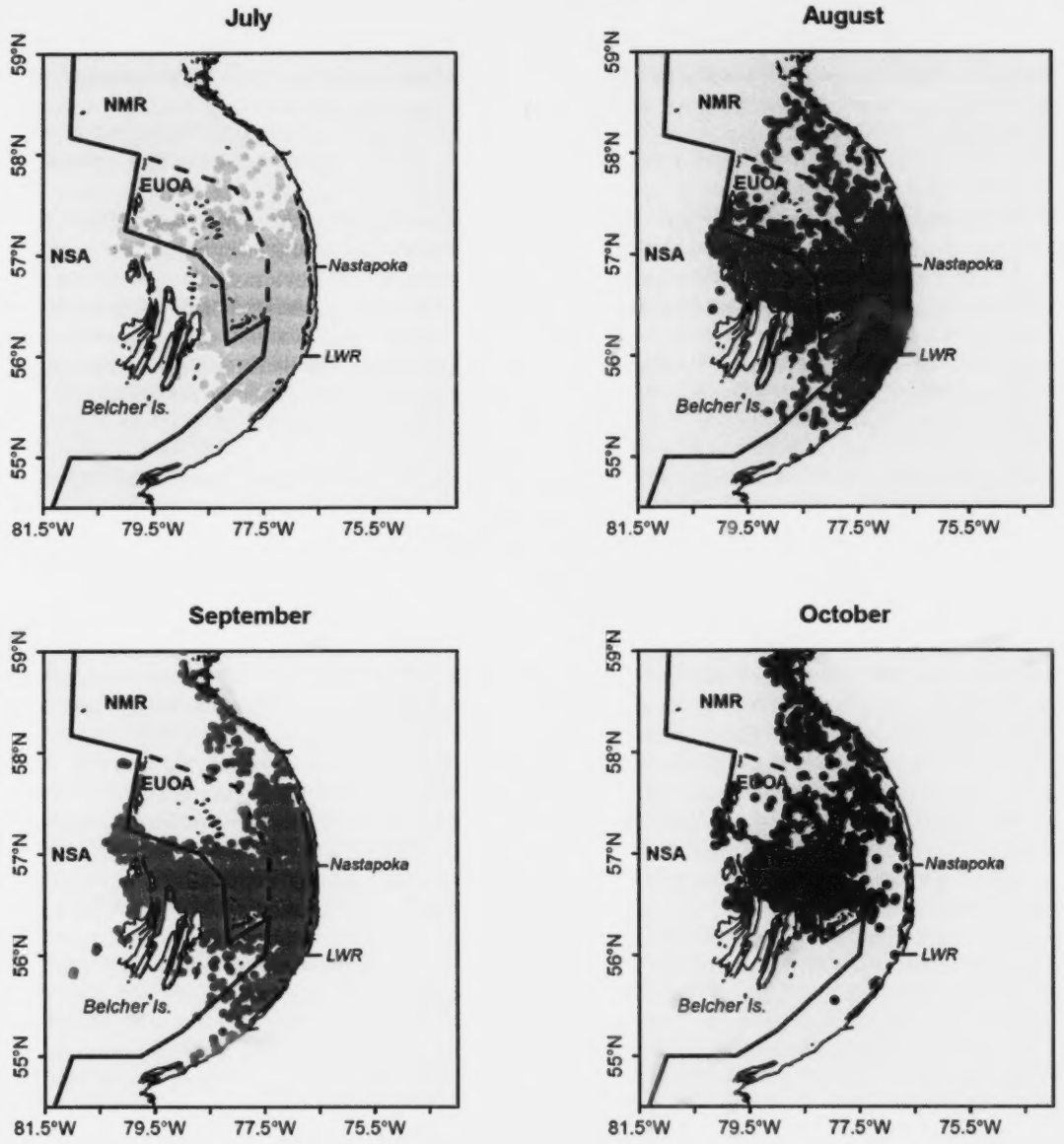

Figure 2. Locations of 34 beluga whales equipped with satellite transmitters in the Little Whale River (LWR, N = 30) and the Nastapoka River (N = 4). NMR: Nunavik Marine Region; EUOA: Equal Use and Occupancy Area; NSA: Nunavut Settlement Area.